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RESEARCH BRIEF

Lottery-Based versus Fixed Incentives to Increase Clinicians' Response to Surveys

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Objective. To compare the effects of lottery-based and fixed incentives on clinicians' response to surveys.

Data Sources. Three randomized trials with fixed payments and actuarially equivalent lotteries.

Study Design. Trial 1 compared a low-probability/high-payout lottery, a high-probability/low-payout lottery, and no incentive. Trial 2 compared a moderate-probability/moderate-payout lottery with an unconditional fixed payment (payment sent with questionnaire). Trial 3 compared a moderate-probability/moderate-payout lottery with a conditional fixed payment (payment promised following response).

Principal Findings. Neither the low-probability nor high-probability lotteries improved response compared with no incentive. Unconditional fixed payments produced significantly greater response than actuarially equivalent lotteries, but conditional fixed payments did not.

Conclusions. Lottery-based incentives do not improve clinicians' response rates compared with no incentives, and they are inferior to unconditional fixed payments.

Key Words. Incentives, response rate, surveys, lottery, behavioral economics

Because low survey response rates increase the potential for nonresponse bias (Schweitzer and Asch 1995; Halpern and Asch 2003), researchers have explored a variety of methods to increase clinicians' response to both postal and web-based surveys. Nuances of the survey technique, such as manipulating the style of the outgoing envelopes (Asch and Christakis 1994) or return postage (Choi, Pack, and Purdham 1990), have produced some success, but financial incentives have generally proven most effective in inducing response (Fox, Crask, and Kim 1988; Asch, Jedrzejewski, and Christakis 1997; Cummings, Savitz, and Konrad 2001). To date, most comparative effectiveness studies of financial incentives have focused on their size. For example, in a randomized trial of U.S.\$2 versus U.S.\$5 prepaid (i.e., unconditional) incentives, the

U.S.\$5 incentive increased response from 46 to 61 percent (Asch, Christakis, and Ubel 1998). Subsequent studies showed that larger prepaid payments may be more effective still, as U.S.\$10 was superior to U.S.\$5 in inducing response (Halpern et al. 2002) and U.S.\$50 was superior to U.S.\$20 (Keating et al. 2008).

However, providing fixed payments of increasing size is expensive and likely yields diminishing marginal returns (Fox, Crask, and Kim 1988). By contrast, insights from the field of behavioral economics suggest that the ways in which similarly sized incentives are structured may alter their effects substantially without influencing their costs (Volpp et al. 2009; Haisley et al. in press). This may be particularly important in the domain of inducing response in web-based surveys, in which it is logistically difficult to incorporate prepaid incentives. Because investigators are increasingly turning to web-based surveys given their convenience, speed, and reduced fixed costs per response (such as mailing costs and data entry), improved methods for inducing response are needed. Although payments can be provided conditionally in web-based surveys—that is, provided after receiving a completed questionnaire—studies have shown that prepaid incentives are superior to such conditional incentives (Weiss, Friedman, and Shoemaker 1985; Berry and Kanouse 1987; Leung et al. 2004), likely because money in hand incites duties of reciprocity (Warriner et al. 1996; Fehr and Falk 2002).

For these reasons and perhaps others, lottery-based incentives appear to offer an attractive means of improving response, particularly in web-based surveys. Lottery-based incentives are administratively simple, potentially inexpensive, offer the enticement of a chance at a large payout, and may take advantage of peoples' tendencies to overestimate small probabilities in the

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face of large potential rewards (Kahneman and Tversky 1979). Despite these theoretical advantages, previous studies on lottery incentives have yielded mixed results. Response rates among members of the public (Kalantar and Talley 1999; Goritz and Wolff 2007) and trauma patients (Harris et al. 2008) generally have not improved with lottery tickets or entries into drawings for gift cards. Among clinicians, available studies suggest that lottery-based incentives produce modest increases in response rate compared with no financial incentives (Baron, De Wals, and Milord 2001; Leung et al. 2002; Robertson, Walkom, and McGettigan 2005) and that lotteries are inferior to unconditional fixed payments (Leung et al. 2002; Ulrich et al. 2005).

However, interpreting these findings is challenging for two reasons: first, none of these research teams informed respondents of their probability of winning the lotteries if they responded, and fixed-payment comparators, when used, were not actuarially equivalent to the lotteries. Thus, it is uncertain whether the observed effects are due to differences in the expected value of the different incentives, or to the different psychological impacts of guaranteed versus chance payments. Second, although lotteries generated lower response rates than prepaid fixed payments, it is unclear whether this effect was due to the differential influence of a guaranteed versus chance (lottery-based) payment or to the fact that the guaranteed payments in these studies were all provided unconditionally, whereas lottery entry was conditional upon response.

Prior studies have also failed to evaluate the effectiveness of different types of lotteries. For example, because people tend overestimate probabilities near zero (Kahneman and Tversky 1979), lotteries with low probabilities of winning large prizes may be more effective than actuarially equivalent lotteries with somewhat higher probabilities of winning smaller prizes.

To address these limitations, we conducted three randomized trials comparing lottery-based incentives to both unconditional and conditional fixed payments as well as to no financial incentive. We had three central hypotheses (1) that relatively affluent clinicians would be swayed more by a small chance for a large lottery payout than by an actuarially equivalent fixed payment because they would tend to be risk-seeking for gains; (2) that low-probability high-payout lotteries would be more effective than higher-probability lower-payout lotteries due to tendencies to pay more attention to the magnitudes of rewards and to overestimate small probabilities; and (3) that lottery-based incentives would compare more favorably versus conditional fixed payments (those promised upon response) than versus unconditional (prepaid) fixed payments because in the latter case, the possibility of a large payment would have to be sufficiently compelling to overcome the induced duties of reciprocity.

METHODS

We conducted three separate randomized trials among different groups of clinicians. In Trial 1, we identified 2,477 critical care physicians through a previously established database of critical care physicians affiliated with all U.S. critical care training programs (Halpern et al. 2007). We sent these physicians an email containing a link to an online survey about organ donation after circulatory determination of death on the commercially available platform <http://www.surveymonkey.com>. Using a random number generator, we assigned 60 percent of physicians to a low-probability, high-payout lottery in which they were informed that if they responded to the survey they would be entered into a lottery with a 1 in 1000 chance of winning U.S.\$5000. We assigned 20 percent of physicians to a high-probability, low-payout lottery, in which they would be entered into a lottery with an advertised 1 in 50 chance of winning U.S.\$250 if they responded. Finally, the remaining 20 percent were randomly assigned to receive no financial incentive. In both lotteries, the expected (actuarial) value of the incentive was U.S.\$5. Per our protocol, the ex post probabilities of success in all lotteries could increase in light of lower-than-expected response, but they could not decrease in light of greater-than-expected response. However, participants were told that the advertised probability was fixed, and they were not subsequently made aware of greater actual probabilities. In all lotteries, the advertised payouts were actually distributed to randomly selected winners.

Trial 2 was a postal survey, using the same questionnaire as in Trial 1, among 1,000 critical care nurses randomly selected from the American Association of Critical Care Nurses mailing list. We randomly assigned 75 percent of the nurses to a lottery with an advertised 1 in 400 chance of winning U.S.\$2000 if they responded (actuarial value = U.S.\$5). The remaining 25 percent of nurses were sent a U.S.\$5 bill in the initial outgoing envelope as an unconditional (up-front) fixed payment.

In Trial 3, using web-based methods identical to Trial 1, we recruited 758 resident physicians to complete a questionnaire regarding their practices when obtaining informed consent for blood transfusion. These 758 potential respondents included all residents from the Departments of Medicine, Surgery, Anesthesiology, and Obstetrics and Gynecology at three hospitals: Brigham and Women's Hospital, the Hospital of the University of Pennsylvania, and Union Memorial Hospital. We randomly assigned 50 percent of residents to a lottery group with an advertised 1 in 250 chance of winning U.S.\$2500. We told the other 50 percent of residents that they would receive a

fixed U.S.\$10 payment after we received their responses (conditional fixed payment). The actuarial value of both incentives was U.S.\$10.

For Trials 1 and 3, we sent email reminders to nonrespondents at 5 and 10 days following the initial invitation. For Trial 2, we sent a single reminder given evidence that a second reminder is not cost-effective in postal surveys (Asch, Christakis, and Ubel 1998). We informed participants in all trials that questionnaire completion required 5 minutes or fewer based on the results of pilot testing.

For all trials, we calculated the “minimum response rate” as the number of completed responses (> 80 percent items completed) divided by all known eligible respondents plus respondents of unknown eligibility (American Association for Public Opinion Research [AAPOR] 2011). We excluded clinicians from whom we received a return envelope or email with an “undeliverable” or “invalid address” message because these clinicians were ineligible to respond (AAPOR 2011). Response rates were compared primarily using chi-squared analyses. Secondary analyses with logistic regression were performed to address possible confounding by known demographic- or practice-related characteristics of the study samples. In all trials, we had at least 80 percent power to detect an absolute difference of 10 percent in the response rates induced by any two incentives.

As a secondary aim, we sought to determine whether different group response rates, as might be introduced by the use of different incentive structures, influenced the results of the surveys themselves. To address this question, we used logistic regression to evaluate the independent effect of incentive group assignment on any of the questionnaires’ main outcome variables, adjusting for potential respondent-level confounders (e.g., sex).

We used *Stata 10.1* software (Stata Corp., College Station, TX, USA) for statistical analyses. All trials were approved by the University of Pennsylvania Institutional Review Board and informed consent was obtained from all trial participants.

RESULTS

In Trial 1, we received a failed delivery message from 271 physicians, leaving 2,206 eligible respondents. As indicated in Table 1, crude response rates were 30.5 percent among physicians assigned to the jackpot lottery, 31.2 percent among those assigned to the high-probability lottery, and 32.4 percent among those who received no financial incentive to respond. None of these response rates was significantly different from either of the other rates (all $p > .30$). In the

Table 1: Critical Care Physicians' Web-Based Survey

<i>Incentive</i>	<i>% Assigned to Arm</i>	<i>Response Rate, N (%)</i>
Low-probability lottery*	60	422/1382 (30.5%)
High-probability lottery†	20	129/414 (31.2%)
No incentive	20	133/410 (32.4%)
Total		684/2206 (31.0%)

$\chi^2 = 0.54, p = .76$.

*Clinicians were informed that the payout was a 1 in 1,000 (0.1%) chance of winning U.S.\$5,000. The actual probability of success, based on the observed number of respondents, was 1 in 422 (0.24%).

†Clinicians were informed that the payout was a 1 in 50 (2.0%) chance of winning U.S.\$250. The actual probability of success, based on the observed number of respondents, was 3 in 129 (2.3%).

multivariable logistic regression model, adjustment for clinicians' gender, region of the United States, and departmental affiliation did not appreciably alter response rates, and there remained no differences between groups (data not shown).

In Trial 2, 12 original envelopes were returned due to invalid postal addresses, leaving 988 eligible respondents. As shown in Table 2, crude response rates were significantly lower among nurses assigned to the lottery-based incentive than among nurses who received an unconditional payment of U.S.\$5 in the outgoing envelope (39.4 versus 58.8 percent; $p < .001$). Neither the gender of respondents nor their region of the United States was associated with these response rates.

In Trial 3, no ineligible respondents were identified; hence, the original 758 residents were retained in our analyses. As shown in Table 3, the crude response rates were similar among residents assigned to the lottery-based incentive and among those who received an actuarially equivalent, conditional fixed payments—that is, a promise that U.S.\$10 would be mailed

Table 2: Critical Care Nurses' Postal Survey

<i>Incentive</i>	<i>% Assigned to Arm</i>	<i>Response Rate, N (%)</i>
Lottery*	75	291/738 (39.4%)
Unconditional fixed payment†	25	147/250 (58.8%)
Total		438/988 (44.3%)

$\chi^2 = 28.4, p < .001$.

*Nurses were told the payout was a 1 in 400 (0.25%) chance of winning U.S.\$2,000. The actual probability of success, based on the observed number of respondents, was 1 in 291 (0.34%).

†Nurses received a U.S.\$5 bill in the initial outgoing envelope of the survey.

Table 3: House Officers' Web-Based Survey

<i>Incentive</i>	<i>% Assigned to Arm</i>	<i>Response Rate, N (%)</i>
Lottery*	50	183/358 (51.1%)
Conditional fixed payment [†]	50	223/400 (55.8%)
Total		406/758 (53.6%)

$\chi^2 = 1.63$, $p = .20$.

*Clinicians were informed that the payout was a 1 in 250 (0.4%) chance of winning U.S.\$2,500. The actual probability of success, based on the observed number of respondents, was 1 in 183 (0.55%).

[†]Clinicians were told that they would receive U.S.\$10 via post after completing the survey.

following receipt of the completed survey (51.1 versus 55.8 percent; $p = .20$). These results were similar after adjustment for participants' gender, hospital, and department.

Finally, we evaluated the influence of different response rates on survey outcomes in Trial 2, the one trial in which differential response rates were observed among arms. Of the five main outcomes assessed in this survey of nurses' views on the management of organ donors after circulatory determination of death, the randomly assigned arms had only modest effects on each; in one case this effect was statistically significant (Table 4).

DISCUSSION

Taken together, these three randomized trials produce two central findings. First, these data suggest that lotteries do not increase clinicians' response rates to surveys. In Trial 1, neither a low-probability/high-payout nor a high-probability/low-payout lottery increased response compared with no incentive, and thus merely added expense to conducting the survey. Second,

Table 4: Influence of Different Response Rates on Survey Results*

<i>Outcome</i>	<i>Adjusted Odds Ratio (95% Confidence Interval)</i>
A	0.61 (0.39–0.93)
B	0.69 (0.45–1.05)
C	0.94 (0.59–1.50)
D	1.29 (0.85–1.96)
E	1.49 (0.84–2.63)

*Odds ratios represent the increase (decrease) in the odds that respondents answered each question affirmatively among those randomly assigned to the fixed-incentive arm relative to the lottery-based incentive arm.

whereas the results of Trial 2 confirm prior research that unconditional fixed payments (e.g., money included in the original outgoing envelope) effectively improve response rates (Asch, Jedrzejewski, and Christakis 1997; Asch, Christakis, and Ubel 1998; Halpern et al. 2002), the results of Trial 3 suggest that conditional fixed payments (e.g., guaranteed payment upon completion of a survey) may not.

We did not compare conditional and unconditional fixed incentives within the same trial because our primary goals were to evaluate the effects of lottery-based incentives. Nonetheless, in contemporaneously conducted trials, we found that unconditional fixed payments led to significantly higher response rates than actuarially equivalent lotteries, whereas conditional fixed payments led to similar response rates as actuarially equivalent lotteries. Because lotteries do not appear to improve response to clinician surveys, this finding suggests that conditional fixed payments may not either.

These results are important for investigators planning future clinician surveys, and particularly for those contemplating use of web-based platforms. Lotteries are particularly tempting for investigators wishing to improve response rates to web-based surveys because it is logistically difficult and potentially expensive to attach an unconditional fixed payment to an electronic solicitation of enrollment. Indeed, even if unconditional payments were sent electronically, they would likely have to be in the form of a coupon, check, or money order. Such noncash incentives may be less influential than actual currency because there are hassles involved in realizing their cash value. Furthermore, people who prefer not to respond may simply refrain from depositing the check or using the coupon (Schweitzer and Asch 1995), thereby avoiding the guilt that would otherwise ensue.

Both lottery-based incentives and fixed incentives conditional on response circumvent these problems, but our results suggest that neither mechanism improves response rates. Thus, it seems that investigators wishing to augment response to web-based clinician surveys will either have to develop novel and secure methods for administering unconditional fixed payments to potential respondents, or utilize other nonfinancial measures to encourage response. Until such methods are developed, investigators may be better off reverting to mail surveys. Rather than wasting resources on incentive structures unlikely to work in web-based formats, these funds might be better employed in support of the time, effort, and unconditional payments required to maximize response to postal surveys.

Our study has several limitations: first, as noted, we did not directly compare unconditional and conditional fixed payments. However, unconditional

payments have repeatedly proven superior to conditional payments in prior head-to-head studies of response to clinician surveys (Weiss, Friedman, and Shoemaker 1985; Berry and Kanouse 1987; Leung et al. 2004). Second, our study did not evaluate the incremental cost-effectiveness of lottery-based incentives relative to fixed incentives. Without evidence that lotteries are effective (e.g., superior to no incentive at all), it is premature to evaluate their cost-effectiveness.

Third, we have not tested all possible ranges of lottery probabilities and reward sizes. However, none of the combinations we evaluated—with expected probabilities ranging from 0.1 to 2 percent and payouts from U.S.\$250 to U.S.\$5,000—clearly improved response rates. Fourth, results obtained in randomized trials of incentive strategies for physicians and nurses may not be generalizable to strategies that might be employed when studying other groups. Physicians and nurses are more affluent than the general population; hence, a lottery entry with an actuarial value of U.S.\$5 or U.S.\$10 may have been insufficient for them but potentially enticing for lower income individuals.

Fifth, the questionnaire used in Trial 3 was different from that used in Trials 1 and 2. Although questionnaire length and content may influence overall response, it is unlikely to preferentially affect response in a particular incentive group. Thus, this does not affect the validity of the relative response rates between fixed and lottery-based incentives. Finally, it is possible that some of the reported results were influenced by participants communicating with each other regarding their assigned incentives. Although such contamination is unlikely to have affected the national samples used in Trials 1 and 2, the residents sampled at three hospitals in Trial 3 could indeed have communicated with each other. We would predict such contamination to yield a substantially lower response among those assigned to a nonpreferred incentive arm; the fact that the two arms in this study yielded similar responses suggests either that little contamination occurred, or that neither incentive was preferred, thereby mitigating any potential effect on relative response rates.

This study provides the strongest evidence to date that lottery-based incentives have little value in clinician surveys. Because the most readily apparent alternative for web-based surveys—promising fixed payments conditional on response—may also lack efficacy, future research is needed to determine whether or how financial incentives can be used to induce response to web-based clinician surveys. Finally, additional research is needed to expand upon our observation that the response rate in a study may have modest effects on the study's results.

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